BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Diploma in Engineering Pearson BTEC International Level 3 Diploma in Electrical and Electronic Engineering Pearson BTEC International Level 3 Diploma in Digital Engineering Pearson BTEC International Level 3 Extended Diploma in Engineering Pearson BTEC International Level 3 Extended Diploma in Electrical and Electronic Engineering Pearson BTEC International Level 3 Extended Diploma in Digital Engineering Pearson BTEC International Level 3 Extended Diploma in Mechanical Engineering
Unit number and title	**Unit 18:** Electrical Power Transmission and Distribution
Learning aim(s)	**C:** Design a distribution system to meet customer requirements for a new electrical installation
Assignment title	Designing a distribution system for a customer.
Assessor	
Issue date	
Hand in deadline	
Vocational Scenario or Context	You are working as a final year apprentice technician for an electrical engineering organisation that generates and transmits electricity. Your job includes a range of activities that are carried out in power generation stations and transmission networks. Your supervisor is pleased with how you examined the design of a typical transmission system and would now like you to design a system to meet the needs of a customer.
Task 1	You are going to produce a design for a new distribution system for a given customer who needs to be connected to the electricity supply. **To do this:** Your tutor will give you information about a customer, including their needs and requirements. You will use this information to design a suitable distribution network to meet their needs, including different potential network configurations and reasons for selecting a particular type to meet them **You will first need to**: Analyse the needs of the customer, including:

a. the responsibilities of the distribution network operator (DNO) in relation to legislation and environmental issues
b. the circuit layouts required,
c. the need for high voltage and low voltage networks, including
    i. substations,
    ii. circuit protection and
    iii. approaches that can be taken to provide earthing.

Consider the location of the development e.g. rural or urban and its impact on decisions made.

You then need to:

Use your analysis to produce logical and suitable designs for the distribution system that meets the customer requirements. You need to include details of:

a. The routing and types cable selected for the distribution network

Select and justify your design decisions with regards to consideration of the responsibilities and roles of the DNO, to include maintaining supply to the customer, resource planning processes and design principles to include regulatory requirements and responsibilities for planning.

Consider the choice between overhead and underground cables, methods of burying underground cables and their differing purposes. Include the impact of choices on costs and environmental concerns regarding routing of cables. Include properties and characteristics of typical conductors, e.g. impedance per metre, cost per metre and ease of installation/jointing. Also include information about the prevention of moisture ingress.

Include the purpose of the high voltage and low voltage networks, methods of interconnection, circuit layouts to and from substations and approaches to protection.

b. Substations and network protection

Plan the need for primary and secondary substations. Determine a workable network of secondary substations from the primary substation taking into account existing installations and potential cost (in broad terms).

Identify forms of substation protection, including equipment and methods of protection, e.g. earth fault protection, barriers and signage to prevent electric shock; principles of substation fusing, including types and characteristics and substation earthing principles.

Identify typical cable faults and methods of fault location, to include open circuit fault location using loop testers and possible supervisory control and data acquisition (SCADA) methods of identification.

c. Explain the purpose of suitable methods of

	interconnecting LV circuits, including: Single end feed, double end feed, closed ring network. **d. alternative approaches for the design of the network.** Refine your designs giving reasons for your decisions, including why approaches were rejected in favour of the preferred solution. It may help the development of your design and justify your solutions if you can use simulation software to test them.
Checklist of evidence required	Design documents for a distribution network for a given customer requirement that justifies all choices made and costs incurred

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
C.D3	Refine, during the process, the design for a distribution system that fully meets the client's brief, justifying the choices made
C.M4	Analyse the client's requirements for the substations, considering the relative merits of building a new or using existing capacity
C.M5	Produce a detailed design for a distribution system, while documenting alternative solutions
C.P5	Explain the client's requirements for a primary and secondary substation on a distribution network
C.P6	Produce a design for a distribution system based on a client brief, describing the construction of the substations

Sources of information to support you with this Assignment	**Books** Power System Analysis and Design, by J Duncan Glover (Author), Thomas Overbye (Author), Mulukutla S Sarma (Author), ISBN-10: 1305632133, ISBN-13: 978-1305632134, has a lot of good examples of using PowerWorld Simulation which learners can develop to address the assignment. Simulation screen shots would be a good way to evidence the efficacy of design decisions. This would allow higher achieving candidates to investigate for example typical loads from domestic houses and to build in maximum load considerations and the impact of faults on lines without the need for extensive calculations. **Websites** edfenergy.com/energy/nuclear-new-build-projects EDF Energy information on nuclear new build projects. onr.org.uk/new-reactors/faq.htm#q3 Generic Design Assessment information from the Office for Nuclear Regulation. bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/radiation/fissionrev2.shtml

	How power stations work. nei.org/Knowledge-Center/How-Nuclear-Reactors-Work Nuclear Energy Institute information on how nuclear reactors work. electronics-tutorials.ws allaboutcircuits.com Above are some examples of websites. Further useful resources may be found at: qualifications.pearson.com/en/support/published-resources.html#step1
Other assessment materials attached to this Assignment Brief	Client brief for a distribution network.

Note to assessor:

Task 1	**General note for assessors** Where possible a range of client briefs should be available to learners. Planning applications for small local domestic developments could form the basis of the client briefs. Real-world scenarios are complex. The requirement is not to design a network equivalent to that by a Chartered Electrical Engineer, but for candidates to demonstrate an understanding of network design and the importance of balancing considerations to meet a customer requirement. The grade awarded should reflect the depth and accuracy of the analysis and design and the justification of decisions made.